

UNITED STATES  
DEPARTMENT OF LABOR  
MINE SAFETY AND HEALTH ADMINISTRATION

COAL MINE SAFETY AND HEALTH

REPORT OF INVESTIGATION

Underground Coal Mine

Fatal Electrical Accident  
September 24, 2004

Fork Ridge Mine  
Cumberland River Coal Company  
Dunbar, Wise County, Virginia  
ID No. 44-07074

Accident Investigators

David N. Woodward  
Mining Engineer

James G. Deel  
CMS & H Specialist (Electrical)

Originating Office  
Mine Safety and Health Administration  
District 5  
P.O. Box 560, Wise County Plaza  
Norton, Virginia 24273  
Edward R. Morgan, District Manager

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## OVERVIEW

On September 24, 2004, at approximately 8:40 p.m., a 46 year-old face equipment operator with 30 years mining experience was fatally injured in an underground coal mine. The victim and a qualified electrician were preparing to connect a high-voltage coupler to a receptacle labeled "FEED THROUGH" on a 7,200 VAC high-voltage switch house. The electrician thought the receptacle was incorrectly labeled and that it was actually an output receptacle. After opening the visual disconnect and cleaning the coupler, he went to the personnel carrier. When he heard the victim cry out, the electrician turned and saw him within arms reach of the exposed receptacle. The victim suffered an electrical shock resulting in the fatality. The feed-through receptacle was energized because the fail safe ground check (monitor) circuit was shorted in another receptacle.

## GENERAL INFORMATION

Cumberland River Coal Company's Fork Ridge Mine is located approximately 3 miles North of Dunbar in Wise County, Virginia. The mine has six drift openings into the Taggart Marker Coal Seam. The only active section is located approximately 2,600 feet from the surface. The mining height averages five feet. The last air sample collected showed no methane liberation. Immediate mine roof typically consists of 11 to 27 feet of gray laminated shale, with sandstone as the main roof.

Thirty-eight underground miners and one surface person are employed at this mine. The mine operates with three eight hour shifts, five days per week. Coal is produced on the 001-0 Mechanized Mining Unit (MMU) on the day and evening shifts. Maintenance and utility work is performed on the midnight shift. At the time of the accident, the section was retreat mining. The mine produces an average of 1,400 raw tons per day while retreat mining and 1,214 raw tons per day when advance mining.

A room-and-pillar system of mining is used at this mine. Coal is produced using a remotely controlled continuous mining machine. Coal is conveyed using a continuous haulage (bridge) system from the face areas to the belt conveyor system for transport to the surface. Trucks are employed to haul the raw product from the mine. Two roof-bolting machines are used to secure the exposed strata. Employees and supplies are transported to the section via either battery or diesel-powered, rubber tire equipment.

The Mine Safety and Health Administration (MSHA) completed the last health and safety inspection of the mine on May 25, 2004. The NFDL (non-fatal days lost) national injury frequency rate from the 2nd quarter of 2004 for underground mines was 8.19, while the rate at this mine was 7.81 during the same period.

## DESCRIPTION OF ACCIDENT

On September 24, 2004, the evening shift (3:00 p.m. to 11:30 p.m.) for Cumberland Coal Company's Fork Ridge Mine began underground operations under the supervision of Ed Creech, Superintendent and Tommy Duncan, Maintenance Superintendent. Work assignments for the evening shift were made prior to both men leaving for the day. Jerry Edwards, Evening Shift Section Foreman, traveled underground to the section with the evening shift crew. The crew arrived on the section at 3:15 p.m. and began producing coal at 3:25 p.m. Rodney Brooks, Electrical Repairman, and Leonard Halcomb, Face Equipment Operator, had received their assignments from Creech and Duncan. They began their shift on the surface of the mine mounting guards on a belt drive. At approximately 6:30 p.m., Edwards transported Greg Caldwell, a sick miner, to the surface of the mine. At approximately 6:45 p.m., Edwards observed Brooks and Halcomb still working on the belt drive as he returned to the section.

Brooks and Halcomb traveled to the section to assist with the installation of pins in the low-low belt (a ground level conveyor system which transports coal from the last bridge to the conveyor belt). After finding that the pins had already been installed, Brooks and Halcomb traveled to the power center for the new section. This power center was located near Survey Station No. 12447 and would be used to provide power for mining the 3 Right Panel when energized. They were to prepare the new power center for connection to the No. 4 Switch House located at Crosscut No. 16, between Survey Station Nos. 12405 and 12408 (See Appendix D, page 23).

Brooks noticed that the high-voltage feed-through receptacle on the new power center did not have a terminator cap. Brooks knew that a terminator cap would have to be installed on the feed-through receptacle prior to energizing the unit or the fail safe ground check circuit would not allow the unit to energize. (See Physical Factors for a description of the function of a fail safe ground check circuit). Brooks and Halcomb searched all of the power centers for a terminator cap. They found one on top of the No. 5 Belt Power Center. The power center was located in same crosscut as the No. 4 Switch House. However, the terminator cap that was found did not have insulators for the three phase leads and Brooks was uncertain whether it was legal to use this type terminator cap. Both men traveled to the surface to find a cap with the phase insulators. Brooks only found a cap identical to the one already in his possession. Brooks called Duncan at his home to assure the legality of using the cap. Duncan informed him that it was alright to use the terminator cap. The two co-workers took their lunch break while on the surface and then returned to the new power center and installed the terminator cap. The high-voltage coupler and the high-voltage receptacle were cleaned. Both men worked to install the high-voltage coupler. Upon completing these tasks both men traveled to the No. 4 Switch House.

Upon arrival, Brooks and Halcomb found a dust cap on the feed-through receptacle and a terminator cap on the output receptacle. This configuration of the caps was the exact opposite of a proper installation. The No. 4 Switch House had two available receptacles (see Appendix D, page 24); a feed-through and an output. Both receptacles were appropriately labeled.

Upon arrival, Brooks checked the Vacuum Circuit Breaker (VCB) for the available output circuit. The VCB was deenergized. He opened and grounded the three phase power to the output using the visual disconnect and observed the three blades in their disconnected and grounded position. Brooks also removed the control power. Brooks did not lock and tag out this circuit because the mechanism used to lock out the circuit was out of alignment and because he was going to be working within sight of the visual disconnect lever.

Brooks mistakenly determined that the feed-through receptacle was the output receptacle based on the erroneous locations of the previously mentioned dust and terminator caps. A male coupler of a high-voltage cable was lying on top of the No. 5 Belt Power Center wrapped in a trash bag. This coupler was the end of the high-voltage cable that had been connected to the 3 Right Panel Power Center earlier in the shift. The high-voltage cable had previously been hung from the roof to the point just above where it was laying on the top of the # 5 Belt Power Center. After mistakenly deciding that the output was located on the opposite end of the No. 4 Switch House, Brooks and Halcomb took the high-voltage cable loose from the roof and moved the male coupler to the opposite end of the No. 4 Switch House.

Meanwhile, a water line had burst on the continuous mining machine, located on the retreat mining section. Rondall Middleton, Mobile Bridge Operator, had been sent to retrieve a piece of water line for the repair. Middleton could not pass the area where Brooks and Halcomb were working until their mantrip was moved out of the travelway. Middleton talked with both men while Brooks moved his mantrip into the adjacent crosscut. Middleton traveled outby this point eight crosscuts to the No. 3 Power Center, located at No. 8 Crosscut, to get the piece of water line.

While Middleton was gone Brooks cleaned the high-voltage male coupler with a rag and removed the dust cover from the feed-through receptacle. Brooks then walked across the travelway into the crosscut where the mantrip had been parked (see sketch page 2), and got a drink with his back to Halcomb. Meanwhile, Halcomb apparently began cleaning the high-voltage female receptacle of the feed-through circuit. Halcomb contacted an energized conductor, receiving a fatal electrical shock.

Brooks heard Halcomb cry out and rushed over to assist him. Halcomb was still breathing but was not responsive. Brooks took his mantrip and went to get Middleton to help him with Halcomb. Brooks found Middleton at the No. 3 Power Center just getting on the diesel mantrip vehicle. Brooks told Middleton that Halcomb was hurt. Middleton followed Brooks back to the accident scene. Middleton assessed Halcomb's condition while Brooks tried to call the section from a mine phone located near the No. 3 Belt Drive. Brooks received no answer and left on his vehicle to go to the section for help.

Wayne Glover, Roof Bolter, heard somebody calling the section. Glover told Edwards that somebody was trying to reach him on the phone. Glover realized the person had sounded out of breath and became concerned that something might be wrong. He informed Edwards of his concerns. Edwards called on the phone but received no immediate answer. Soon afterward, Middleton began calling on the phone and told Edwards that "Halc was down." Edwards and Glover immediately went to the mantrip. Before they could take it off charge Brooks arrived on his vehicle. Edwards and Glover boarded Brooks' vehicle and traveled to the accident site.

Meanwhile, Middleton had detected a slight pulse and had cleared Halcomb's airway preparing him for Cardio Pulmonary Resuscitation (CPR). Edwards, Glover and Brooks arrived. Edwards immediately took over and began CPR on Halcomb. Middleton left on the diesel man-trip vehicle to retrieve the defibrillator. Glover assisted Edwards with the CPR by doing the chest compressions. Mitch Mullins, Scoop Operator, and Brian Hatfield, Outby Worker, arrived with the back board and first aid kit. During this time Brooks placed the dust cover back on the female receptacle. Middleton arrived with the defibrillator. Edwards and Delbert Williams, Outby Worker, attached the defibrillator to Halcomb. The defibrillator advised not to shock the patient. Halcomb was loaded onto the diesel man-trip vehicle. The defibrillator had to be removed to keep it from hitting the roof during transport. Edwards continued CPR while Middleton drove the man-trip to the surface. Upon arriving on the surface, the defibrillator was reattached, the defibrillator advised to shock the patient and the shock was administered. The Appalachia Rescue Squad transported Halcomb to the Norton Community Hospital, located in Norton, Virginia. Halcomb was pronounced dead by Dr. Maurice Nida, Wise County Coroner.

## INVESTIGATION OF ACCIDENT

Leroy Mullins, Safety Director, notified Allen Dupree, Assistant District Manager, of the fatality at 9:35 p.m. on September 24, 2004. An Order was issued pursuant to section 103(k) of the Mine Act to ensure the health and safety of persons at the mine until the investigation could be completed. Officials with Cumberland River Coal Company, Virginia Department of Mines, Minerals and Energy (VDMME), and MSHA made arrangements for a joint investigation at the mine. The accident investigation team members arrived at the mine at approximately 9:00 a.m. on September 25, 2004. The accident scene was inspected, photographed, videotaped and measured. A spot inspection was conducted concurrently with the investigation to address any enforcement issues for violations not contributing to the fatality. The fail safe ground check defect was found and corrected. The high-voltage system was thoroughly tested by MSHA and VDMME electrical personnel to assure that all safety features had been restored to their proper operating condition. The 103(k) Order was modified to allow the company to resume normal operations.

MSHA and the VDMME jointly conducted interviews on September 27, 2004, at the company's Pardee Complex offices. Eight people were interviewed: four supervisory employees and four hourly employees. On October 21, 2004, three supervisory employees and seven hourly employees were re-interviewed at the MSHA Norton District Office. The witnesses were placed under oath during these interviews. The 103(k) Order was terminated on December 8, 2004, following the implementation of the provisions of an action plan developed by the operator.

## DISCUSSION

### Physical Factors

The No. 4 Switch House had two available receptacles (see Appendix D, page 24), a feed-through and an output. Both receptacles were clearly and appropriately labeled. However, a dust cap had been installed on the feed-through receptacle and a terminator cap had been installed on the output receptacle. This configuration of the caps was the exact opposite of a proper installation.

All high-voltage resistance grounded systems are required to have a fail safe ground check circuit that continuously monitors the grounding circuit to assure continuity. This system causes the circuit breaker to open when either the ground or pilot check wire is broken or intentionally opened. When the high-voltage circuit comes to an "end", which would be the feed-through receptacle in this case, a terminator cap must be installed on that receptacle to complete the fail safe ground check circuit. The terminator cap has a pilot and ground pin which connect to the pilot and ground of the receptacle thus completing the circuit (see Appendix B, page 20). If this circuit is broken by removing the terminator cap or a rock falling on the cable, etc., the high-voltage circuit is de-energized by the circuit breaker. (See Appendix D, page 24 for a sketch and description of a fail safe ground check circuit.) The dust cap's only purpose is to prevent dust and other foreign materials from accumulating in the receptacle.

The pilot (monitor) pin in the high-voltage coupler that was connected to the output of the No. 5 Power Center (Belt Transformer) was bent (see Appendix B, page 20). Due to the condition of the pilot pin, it had come in contact with the frame and had effectively short-circuited the fail safe ground check circuit. This condition removed the fail safe ground check protection from the No. 4 Switch House feed-through receptacle. This condition allowed the No. 4 Switch House to remain energized without a terminator cap on the feed-through receptacle.

Most high-voltage electrical installations, which use couplers, come equipped with a guide screw which assists in the alignment of the three phase leads, and the ground and pilot (monitor) pins installation. The guide screw is located on the female feed-through receptacle. The male coupler is correspondingly designed with a slot to accommodate the screw and thus maintain proper alignment. The guide screw that originally came in the No. 5 Belt Power Center (Belt Transformer) output receptacle (or one similar to it) was not maintained. This factor probably contributed to the bent ground fault circuit pin.

Prior to the accident, a male high-voltage coupler was lying on top of the No. 5 Belt Power Center wrapped in a trash bag. This coupler was a part of the high-voltage cable that was to be connected to the output of the No. 4 Switch House to provide power for the 3 Right Panel Power Center. The high-voltage cable leading to the coupler was

attached to the roof. The high-voltage cable was taken loose from the roof by Brooks and Halcomb and the male coupler was moved to the feed-through receptacle of the No. 4 Switch House. This action negated earlier work that had been performed in preparation for the correct connection of the coupler.

### **Human Factors**

Brooks, the electrician involved in the accident, had 35 years of electrical experience. Halcomb, the victim, had 30 years of mining experience, most of which was in Kentucky. An examination of certification records revealed that Halcomb did not have an electrical card in Virginia or Kentucky, though statements had been made that he had been a qualified electrician in Kentucky.

On the night of the accident, a decision was made by Brooks and Halcomb to connect a high-voltage male coupler to the feed-through on the No. 4 Switch House. The following is a list of factors which may have influenced this decision:

1. Brooks assumed that the feed-through receptacle was actually the output receptacle. Brooks made the assumption based on a terminator cap on the output receptacle and a dust cap on the feed-through receptacle.
2. When given a sketch of the No. 4 Switch House, Brooks drew the energized portions of the No. 4 Switch House exactly opposite the existing conditions at the time of the accident (See Appendix D, page 26).
3. Brooks did not set the No. 4 Switch House in its physical location although Brooks had previously set switch houses. Testimony did not reveal a standard way for installing a switch house or a belt power center. However, Brooks indicated the No. 4 Switch House was installed exactly opposite of how he used to set them. Brooks stated he would install the switch house with the outputs facing in the direction that the high-voltage cables would be run because it was "less cable and less confusion."
4. The visual disconnects on all other electrical equipment in the mine (power centers, transformers, etc.) are located on or near the input end of the equipment. When the visual disconnects on these pieces of equipment are opened and grounded, work can be performed on the equipment. The No. 4 Switch House has two visual disconnects which are for each of the outputs and not for the feed-through circuit. When either of these disconnects is opened and grounded, work can only be done on that particular output or on equipment being fed by that output. Brooks mistakenly thought that he had de-energized the proper receptacle.

5. It should not have been possible to energize the No. 4 Switch House with a dust cover on the feed-through receptacle because the fail safe ground check circuit would have been open. In this case it was energized and remained so due to the short circuit of the fail safe ground check circuit caused by the bent pilot (monitor) pin.

### **Maintenance, Checks and Testing**

George Miller, Third Shift Maintenance Foreman, made the required monthly high-voltage checks on August 22, 2004. Miller made the original high-voltage connections to the No. 4 Switch House and the No. 5 Belt Power Center (see Appendix D, page 27). The high-voltage configuration at the time of the accident (see Appendix D, page 25) was in place at the time of these high-voltage checks. Miller checked the fail safe ground check circuit and reported it to be in proper operating condition at that time. The male high-voltage coupler, in which the pilot (monitor) pin was bent, had to have been disconnected and the pin bent during the reconnection. This would have occurred between the August examination and the time of the accident. The pilot (monitor) pin could have been bent during a reconnection of the high-voltage coupler.

The guide screw that originally came in the No. 5 Belt Power Center output receptacle (or one similar to it) was not maintained. If this guide screw had been maintained it could have assisted in aligning the pilot (monitor) pin, reducing the possibility of the pin being bent.

### **Locking, Tagging and Grounding**

Brooks opened the visual disconnect on the No. 4 Switch House for the No. 2 Output Circuit de-energizing the unused output receptacle. Brooks did not lock, tag out and ground this circuit for two reasons: 1.) The mechanism on the disconnect lever used for locking out was out of alignment removing any convenient means of locking out. 2.) Work was to be performed within sight of the disconnect. Neither of these are permitted within the regulations in lieu of locking and tagging out.

Proper locking and tagging out procedures were not followed for the work to be done on the No. 4 Switch House feed-through receptacle. The reason for this failure was the mistaken impression that the circuit being worked on was the deenergized output circuit. Proper procedures for working on the feed-through circuit would be to lock and tag out at the surface substation.

## **ROOT CAUSE ANALYSIS**

Causal Factor: A dust cap was located on the feed-through receptacle and a terminator cap was located on the output receptacle.

Corrective Actions: An action plan has been submitted and implemented by the company. The plan required immediate retraining of all electricians and helpers on appropriate caps for feed-through and output receptacles. Also, more extensive retraining occurred at the annual electrical retraining held on October 16, 2004.

Causal Factor: Brooks stated that the No. 4 Switch House was installed exactly opposite of how he used to install them at previous operations.

Corrective Actions: An action plan has been submitted and implemented by the company. The plan required immediate retraining of all electricians and helpers on the importance of reading and following VCB and Power Center/Transformer labels and on appropriate operation of VCB's.

Causal Factor: All other electrical equipment (transformers, power centers, etc.) have a visual disconnect on the input end.

Corrective Actions: An action plan has been submitted and implemented by the company. The plan required immediate retraining of all electricians and helpers on the importance of reading and following VCB and Power Center/Transformer labels and on appropriate operation of VCB's.

Causal Factor: The appropriate circuit was not locked and tagged out.

Corrective Actions: An action plan has been submitted and implemented by the company. The plan required immediate retraining of all electricians and helpers on the on appropriate operation of VCB's and tag and lockout procedures.

Causal Factor: The pilot (monitor) pin, in the high-voltage coupler attached to the No. 5 Belt Power Center, was bent short-circuiting the fail safe ground check circuit.

Corrective Actions: An action plan has been submitted and implemented by the company. The plan requires more extensive retraining of all electricians and helpers in high-voltage system testing, operation and maintenance.

Causal Factor: A guide screw (alignment pin) for the No. 5 Belt Power Center Feed-Through Receptacle was not maintained.

Corrective Actions: An action plan has been submitted and implemented by the company. The plan required all electrical high-voltage receptacles to be inspected for the presence of guide pins. If pins are missing or inoperative, new guide pins will be reinstalled. All cathead receptacles will be inspected and corrected within 60 days, if repairs are needed.

## CONCLUSION

The accident occurred when the victim contacted an energized 7,200 VAC high-voltage feed-through receptacle while attempting to clean the receptacle. The qualified electrician assumed they were working on the output receptacle based on the receptacle cover. When an inappropriately located dust cover was removed from the feed-through receptacle it remained energized. The receptacle did not deenergize because a bent pilot (monitor) pin short circuited the fail safe ground check system in a coupling in the adjacent belt transformer.

The accident resulted from failure to properly: identify the correct high-voltage receptacle, deenergize and ground, lock and tag-out, provide a functioning fail safe ground check circuit and to properly maintain the system.

Approved:

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Edward R. Morgan  
District Manager

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Date

## ENFORCEMENT ACTIONS

A Section 103(k) Order was issued that stated "This mine has experienced a fatal accident while a person was performing electrical work at an underground 7200 volt ac three phase splitter box/ power center next to the two right section belt. This order is issued to assure the safety of all persons at this operation. It prohibits activity in the mine until MSHA has conducted an investigation to determine that it is safe to resume normal mining operations. Only those persons deemed necessary by MSHA/DMME, company officials and miners representatives may enter or remain in the affected area."

A Section 104(a) Citation was issued for a violation of 30 CFR 75.705, which stated "The high-voltage lines supplying 7,200 VAC, three phase power to the No. 4 switch house located underground at this mine were not de-energized and grounded before work was performed on them on September 24, 2004. Leonard Halcomb, Face Equipment Operator, performed electrical work on the underground high-voltage feed-through receptacle of the No. 4 switch house without the circuit being properly de-energized and grounded. Rodney Brooks, Evening Shift Electrician, had opened the visible disconnects and the vacuum breaker leading to the unused output of the No. 4 switch house. However, this action did not de-energize and ground the No. 4 switch house feed-through. Brooks removed the dust cover from the feed-through receptacle and cleaned a high-voltage coupler. The victim appears to have been cleaning the receptacle prior to connecting the coupler for the cable that would energize a new section power center. This information was obtained during a fatal accident investigation which commenced September 25, 2004"

A Section 104(a) Citation was issued for a violation of 30 CFR75.511 which stated "The visual disconnecting device at the surface substation for the underground high-voltage circuit at this mine was not locked out or suitably tagged by the person performing electrical work at the No. 4 switch house on September 24, 2004. Leonard Halcomb, Face Equipment Operator, performed electrical work on the underground high-voltage circuit without locking out or tagging the disconnecting device. Rodney Brooks, Evening Shift Electrician, opened the visual disconnects to the unused output of the No. 4 switch house mistakenly thinking this de-energized the circuit on which work was performed. The disconnecting device at the surface is the only means to disconnect the circuit. Also, electrical work was performed on a high-voltage circuit by a non-qualified person not under the direct supervision of a qualified person at this mine. This resulted in fatal injuries to Leonard Halcomb, Face Equipment Operator. Rodney Brooks, Evening Shift Electrician was the only qualified electrician at the mine. Brooks was in the area but had not directed Halcomb to perform electrical work. Halcomb was not a qualified electrician in Virginia. This information was obtained during a fatal accident investigation which commenced September 25, 2004."

A Section 104(a) Citation was issued for a violation of 30 CFR75.803 which stated “No fail safe ground check circuit was provided for that portion of the grounding circuit of the 7200 volt, three phase power circuit from the No. 5 Belt Transformer (power center) to the No. 4 switch house. The ground check circuit was inadvertently terminated at the feed-through receptacle on the No. 5 Belt Transformer (power center) due to misalignment of the monitor (pilot) pins of the coupler and receptacle which resulted in the pilot to ground contact. This resulted in the fatal injuries received by Leonard Halcomb, Face Equipment Operator. This information was obtained during a fatal accident investigation which commenced September 25, 2004.”

A Section 104(a) Citation was issued for a violation of 30 CFR75.512 which stated “The No. 5 belt drive transformer (power center) was not properly maintained. The guide screw originally located in the feed-through female receptacle is no longer present. The guide screw is designed to assist in proper alignment of three phase leads and ground and monitor (pilot) pins during installation. This information was obtained during a fatal accident investigation which commenced September 25, 2004.”

**APPENDIX A**  
**Persons Present During the Investigation**

**CUMBERLAND RIVER COAL COMPANY - MANAGEMENT**

Thurman Holcomb ..... General Manager  
Ed Creech ..... Superintendent  
Tommy Duncan..... Maintenance Superintendent  
Jerry Edwards..... Second Shift Foreman  
George Miller ..... Maintenance Foreman - Owl shift

**CUMBERLAND RIVER COAL COMPANY**

Mark Heath ..... Attorney  
Tony Bumbico..... Corporate Safety  
Leroy Mullins ..... Safety Director

**CUMBERLAND RIVER COAL COMPANY - LABOR**

Reece Maggard ..... Face Equipment Operator  
..... President of Scotia Employees Association  
Eddie Bentley ..... Repairman/Miner's Representative-Night Shift  
..... Vice President of Scotia Employees Association  
Rodney Brooks ..... Repairman-Night shift  
Carlos Combs..... Repairman-Day shift  
Robert Lovell..... Repairman/Mine Examiner - Day Shift  
Wayne Glover ..... Roofbolter Operator-Night shift  
Rondall Middleton..... Bridge Operator-Night shift  
John Monhollen..... Repairman-Owl shift  
Danny Lawson..... Repairman-Owl shift  
Greg Hall ..... Repairman-Owl shift

**VIRGINIA DEPARTMENT OF MINES, MINERALS AND ENERGY**

Frank Linkous..... Chief, Department of Mines  
Carroll Green ..... Mine Inspection Supervisor  
Dwight Miller ..... Coal Mine Technical Specialist  
Robert Garrett..... Coal Mine Technical Specialist  
Daniel Perkins..... Coal Mine Technical Specialist  
David Asbury ..... Mine Technical Engineer  
Sammy Fleming..... Coal Mine Inspector  
Danny Mann ..... Coal Mine Inspector

**MSHA DISTRICT 5**

Edward R. Morgan .....District Manager  
Allen Dupree ..... Assistant District Manager - Technical Division  
Norman G. Page .....Assistant District Manager - Inspection Division  
Nick Rasnick ..... Coal Mine Inspection Supervisor  
James W. Poynter ..... Coal Mine Inspection Supervisor  
Andrew C. Moore ..... Electrical Supervisor  
James Hackworth ..... Educational Field Services (Supervisor)  
Jason Lane ..... Electrical Engineer  
James G. Deel ..... Electrical Specialist  
John Godsey ..... Roof Control Specialist  
Garey Farmer ..... Coal Mine Inspector  
David N. Woodward ..... Mining Engineer

**APPENDIX B**  
**Photographs**

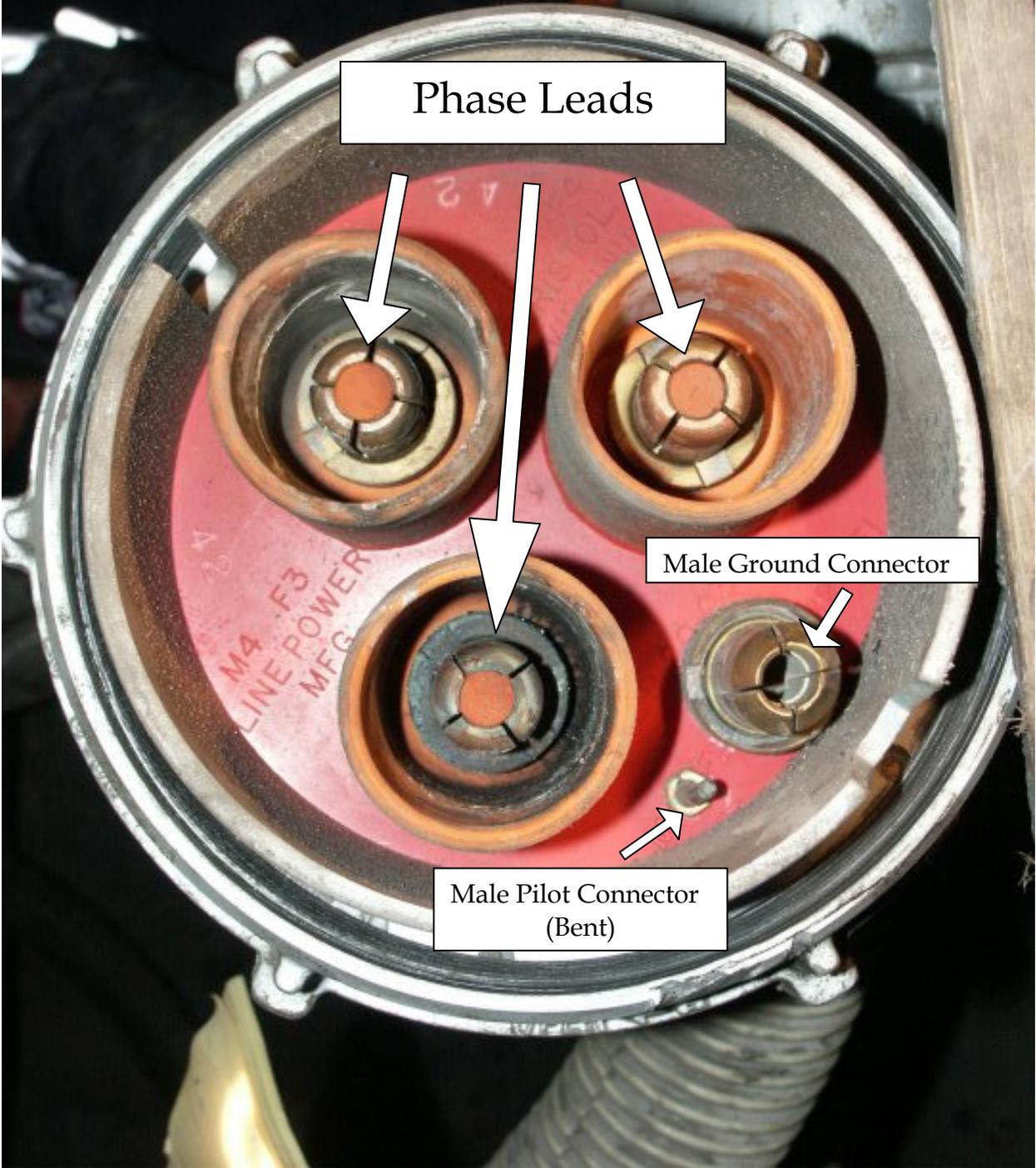
Terminator Cap with Insulator



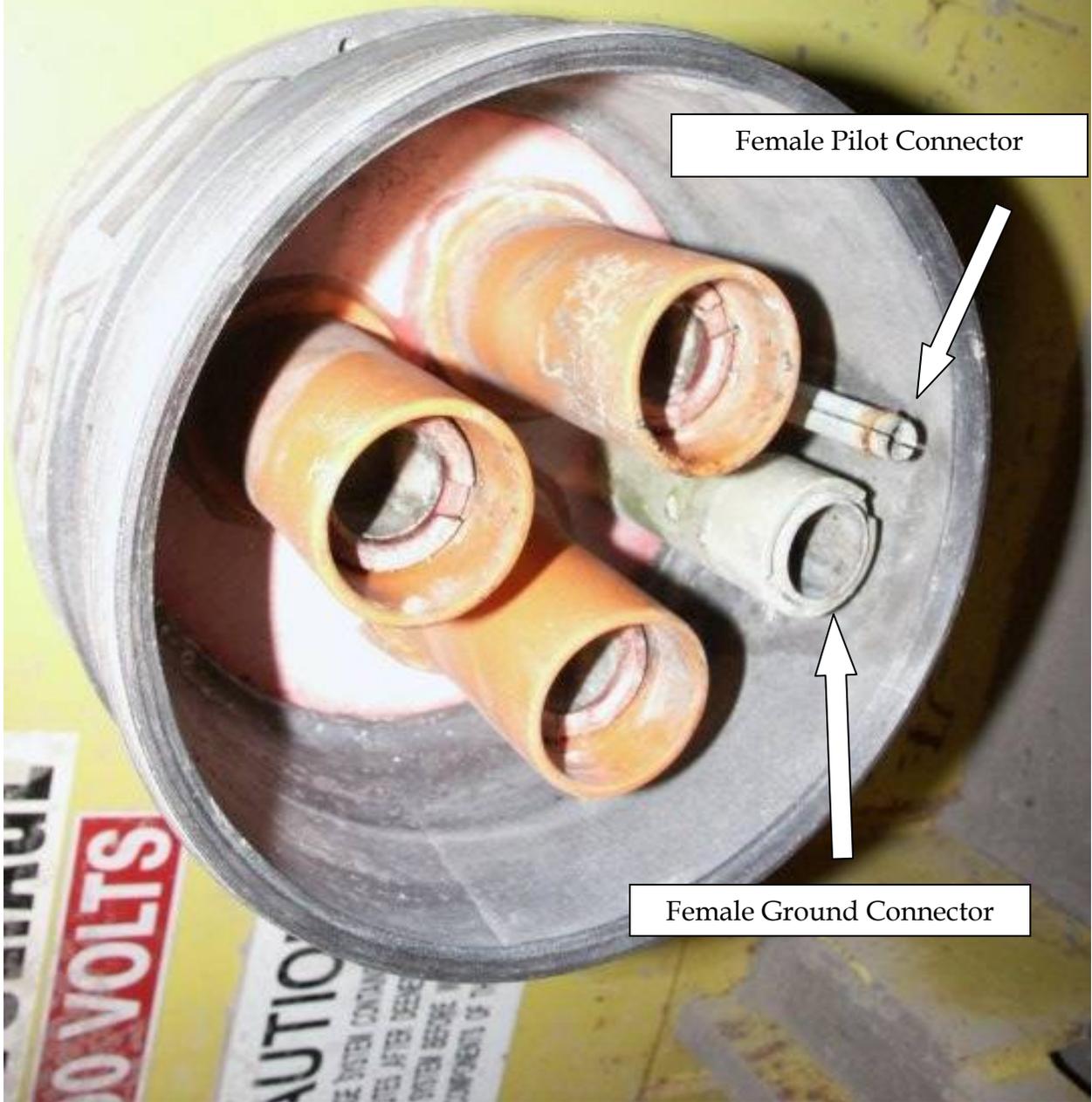
Male Ground Connector

Male Pilot Connector

# High Voltage Coupler



# High Voltage Receptacle



Female Pilot Connector

Female Ground Connector

**APPENDIX C**  
**Maps and Illustrations**